

November 21, 2003

## CRUISE RESULTS

### Gulf of Maine Northern Shrimp Survey

July 27 - August 8, 2003

#### Introduction

This report summarizes results of the 2003 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 20<sup>th</sup> survey conducted by the Northeast Fisheries Science Center (NEFSC) in cooperation with the Northern Shrimp Technical Committee of the Atlantic States Marine Fisheries Commission. The survey is designed to provide data required for annual stock assessments and related tasks.

#### Methods

The survey cruise was conducted between July 27-August 8 aboard the R/V GLORIA MICHELLE, a 65-foot, 96 gross registered ton (GRT) stern trawler powered by a 365 horsepower Caterpillar diesel engine. Fieldwork was overseen by NEFSC staff. Participants included Technical Committee members, one member of the Atlantic States Marine Fisheries Commission, and other personnel from the NEFSC and state agencies of Maine and Massachusetts (see Appendix I). Data entry and analyses were performed at the NEFSC.

A stratified random sampling design was used (Figure 1). Stations were allocated to strata roughly in proportion to the area of the strata and additional non-random stations were also occupied. Field work was conducted during daylight hours to account for diel changes in northern shrimp availability. The survey was comprised of three parts; Part I was during 27-31 July; Part II, 1-5 August; Part III, 6-8 August 2003. The vessel departed Woods Hole, MA and headed to Boothbay Harbor, ME; Boothbay Harbor, ME to Gloucester, MA, and Gloucester, MA returning to Woods Hole, MA. Locations of stations sampled during each part are given in Figure 2.

At each station a 15 minute tow was made at a vessel speed of two knots. Gear consisted of a four-seam modified commercial shrimp trawl fished at a scope of 3:1 in depths up to and including 85 fathoms; in depths between 85-100 fathoms, 250 fathoms of wire was used; and in depths greater than 100 fathoms, the scope was 2.5:1. Reference/hull surface temperatures and meteorological observations were recorded at each station. The Vemco minilogger for Windows Base stations was used to record the bottom temperatures during the survey. Northstar Technical Inc. Netmind Trawl Monitor System was utilized opportunistically (used for first two parts of the survey) when sea-state and weather permitted for the length of the survey. Headrope height, wingspread and doorspread of the trawl were recorded to a Dell laptop computer.

In all instances where feasible, a 2 kilogram (kg) sample of pandalid shrimp was collected for determination of species composition. Length frequency measurements were collected for northern shrimp (mid-dorsal carapace length, rounded down to the nearest 0.5 millimeter) in addition to sex and female spawning condition (Rasmussen 1953; McCrary 1971). In cases in which less than 2 kg of shrimp were caught, the entire catch was processed as described above.

For other species of invertebrates and finfish, standard NEFSC bottom trawl survey techniques (Azarovitz 1981, Grosslein 1969) were used to process the catch. Bony fish were measured (nearest centimeter (cm) to the end of the central caudal ray; American lobster were measured in millimeters (mm) from eye socket to end of carapace; and carapace width (cm) was recorded for crabs. Bivalves were measured by shell height (cm) and cephalopods were measured by mantle length (cm). All species weights were recorded to the nearest 0.1 kg. The remainder of the catch (miscellaneous invertebrates, trash, etc.) was recorded by weight. Total weight and sample length frequencies for each species were recorded on standard NEFSC Bottom Trawl Survey forms, which were retained for processing and computer entry.

## Results

A total of 62 stations were occupied. Northern shrimp were taken at 60 stations (Table 1). There were 16 non-random fixed stations. Strata 1, tows 6 and 7 had the highest total number of northern shrimp while the lowest number were taken in Strata 3 and 4.

All shrimp, finfish, and select invertebrate data has been key-

entered, audited, and archived in computer data files (total weight, number, and length frequencies). Scientific sample collections are summarized in Table 2. This information is available on request (refer to NEFSC Survey Master Data files Cruise Code 2370).

#### REFERENCES

Azarovitz, T. R. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. Can. Spec. Publ. Fish. Aquat. Sci., 58: 62-67.

Grosslein, M. D. 1969. Groundfish survey methods. NMFS, Woods Hole, Lab. Ref. Doc. 69-2, 34p.

McCrary, J. A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. J. Fish. Res. Board Can., 28: 98-100.

Rasmussen, B. 1953. On the geographical variation in growth and sexual development of the deep-sea prawn (Pandalus borealis kr.). Norway Fish. Mar. Invest. Rep., 10 (3); 1-160.

Table 1. Summary of station and northern shrimp collected on the 2003 northern shrimp survey in the western Gulf of Maine aboard the R/V GLORIA MICHELLE, July 27-August 8, 2003.

Stratum	Station	Latitude	Longitude	Depth (m)	Bottom Temp(C)	Weight (kg)	Total No.	Total No. ≥ 22 mm
tow	41	42 56	70 29	10	4.7	9.7	1,445	712
01-01	40	42 59	70 18	159	4.0	75.6	10,145	3,683
01-02	38	43 09	70 17	115	4.5	17.8	3,471	1,063
01-03	43	42 51	70 33	97	4.3	26.3	4,608	1,943
01-04	36	43 21	70 07	113	4.8	1.3	133	49
01-05	37	43 14	70 06	150	4.6	141.2	26,340	2,925
01-06	39	42 58	70 15	159	4.4	144.1	22,510	6,000
*01-07	42	42 53	70 28	106	4.5	54.1	7,749	3,374
*01-08	44	42 31	70 25	112	5.2	26.6	4,075	1,662
*02-01	45	42 24	70 30	86	4.7	9.1	828	725
*02-02	30	43 18	69 45	150	4.7	25.1	3,003	1,378
03-01	34	43 09	69 49	174	5.9	16.1	1,839	1,025
03-02	28	43 34	69 47	106	5.3	17.6	2,845	880
03-03	32	43 09	69 43	124	4.7	0	5	0
03-04	27	43 34	69 47	106	5.6	0	0	0
03-05	29	43 21	69 45	166	5.0	66.6	8,137	3,641
03-06	3	42 56	69 30	170	5.2	8.8	1,187	736
03-07	31	43 12	69 45	134	4.8	1.3	131	89
03-08	26	43 29	69 34	137	4.5	35	4,852	2,127
03-09	33	43 06	69 46	159	5.0	18.6	2,239	1,311
*03-10	35	43 21	69 58	168	4.7	97.6	17,001	2,750
*03-11	61	42 09	69 49	124	5.1	0	2	0
04-01	62	42 19	70 03	148	5.0	0	7	2
04-02	60	42 06	69 52	124	5.0	0	0	0
*04-03	47	42 41	69 52	238	6.2	3.7	625	221
05-01	46	42 46	69 57	216	6.1	2.9	342	192
05-02	59	42 04	69 45	182	5.5	1.8	239	115
05-03	1	42 54	69 45	200	6.2	8.1	1,122	586
*05-04	2	42 46	69 37	225	6.1	1.8	174	142
*05-05	22	43 31	69 04	124	4.9	1.1	171	67
06-01	9	42 43	69 00	150	5.6	0.7	109	45
06-02	14	43 11	69 10	190	5.9	17.7	2,285	1,269
06-03	21	43 29	69 05	135	4.9	14.7	2,225	806
06-04	24	43 35	69 27	154	4.7	75.2	10,981	2,166
06-05	4	42 51	69 24	148	5.2	6.9	1,115	486
06-06	23	43 39	69 25	135	4.9	4.1	667	346
06-07	10	42 53	69 09	161	5.3	7.0	966	589
06-08	13	43 09	69 06	168	6.1	21.1	3,497	1,520
06-09	12	43 04	69 09	159	4.9	17.5	2,746	1,043
06-10	25	43 19	69 22	172	4.4	33.5	4,915	1,682
*06-11	49	42 19	69 07	229	5.8	1.6	194	127
07-01	6	42 37	69 25	229	6.2	2.4	303	177
07-02	5	42 47	69 25	188	5.9	0.8	120	87
07-03	56	41 42	69 13	186	5.2	0	0	0
07-04	7	42 38	69 16	207	6.2	1.5	207	96
*07-05								

*07-06	48	42 26	69 03	208	6.2	0.1	11	9
07-07	57	41 42	69 13	185	5.1	4.1	555	357
*08-01	19	43 32	68 47	146	6.7	20.1	2,719	1,708
08-02	15	43 16	68 53	155	5.8	7.0	1,071	628
08-03	8	42 36	68 56	163	6.1	0.3	37	18
08-04	20	43 31	68 51	134	6.5	15.7	2,434	1,041
Stratum tow	Station	Latitude	Longitude	Depth (m)	Bottom Temp(C)	Weight (kg)	Total No.	Total No. ≥ 22 mm
08-05	16	43 21	68 52	117	6.4	0	4	2
08-06	18	43 34	68 39	139	6.7	10.4	1,405	721
08-07	17	43 21	68 32	179	6.0	12.0	1,484	995
*08-08	11	42 59	68 50	179	6.1	20.1	3,256	994
09-01	52	42 17	68 35	163	5.9	1.2	163	120
09-02	51	42 25	68 43	199	7.3	4.6	622	361
*09-03	50	42 31	68 45	185	6.2	2.0	294	160
*09-04	53	42 14	68 40	192	5.5	2.7	411	207
12-01	58	41 59	69 49	102	5.2	0	0	0
12-02	54	42 05	68 51	146	4.9	0.8	133	75
12-03	55	41 49	68 60	161	5.0	8.7	1,111	763

\* non-random tow

Table 2. Miscellaneous scientific collections made on the 2003 northern shrimp survey in the western Gulf of Maine aboard the R/V GLORIA MICHELLE, July 27-August 8, 2003.

Approximate Number	Investigator & Affiliation	Samples Saved
Woods Hole, MA	Aquarium, NMFS, NEFSC,	Shrimp 2 boxes
Woods Hole, MA	John Burnett, NMFS, NEFSC,	Goosefish vertebrae 90 samples
Woods Hole, MA	Kathy Sosebee, NMFS, NEFSC,	White hake otoliths 229 samples

Figure 1. Northern shrimp survey strata and observed  
distribution of catch per tow (kg) of northern  
shrimp collected during the 2003 survey in the  
western Gulf of Maine aboard the R/V GLORIA  
MICHELLE, July 27- August 8, 2003.

Figure 2. Trawl hauls made from the RV GLORIA MICHELLE, during  
National Marine Fisheries Service, Northeast  
Fisheries Science Center summer northern shrimp  
survey(03-07), July 27 - August 8, 2003.



Appendix I. Participants on the 2003 northern shrimp survey  
cruise in the western Gulf of Maine, aboard the  
R/V GLORIA MICHELLE, July 27-August 8, 2003.

National Marine Fisheries Service, NEFSC, Woods Hole, MA  
Charles Keith, Chief Scientist<sup>1, 3</sup> 7/27-31, 8/6-8  
Peter Chase, Chief Scientist<sup>2</sup> 8/1-5  
Sandra Sutherland<sup>3</sup>

MA Division of Marine Fisheries, Pocasset, MA  
Robert Glenn<sup>2</sup>  
Dennis Nault<sup>1</sup>

MA Division of Marine Fisheries, Gloucester, MA  
John Shepherd<sup>1</sup>

MA Division of Marine Fisheries, Boston, MA  
Daniel McKiernan<sup>2</sup>

MA Division of Marine Fisheries, Newburyport, MA  
Mark Rousseau<sup>2</sup>

ME Department of Marine Resources, West Boothbay Harbor, ME  
Vincent Manfredi<sup>3</sup>  
Robert Russell<sup>3</sup>  
Daniel Schick<sup>2</sup>  
Lessie White<sup>1</sup>

Atlantic States Marine Fisheries Commission, Washington, DC  
Bradley Spear<sup>1</sup>

National Marine Fisheries Service, NEFSC, Highlands, NJ  
John Hilbert, Third Mate<sup>1, 2, 3</sup>  
Jeanne Nicolosi, Seaman<sup>1, 2, 3</sup>

NOAA Corps, Highlands, NJ  
LT Russell G. Haner, Commanding Officer<sup>1, 2, 3</sup>  
LTJG Scott Wingerter, Executive Officer<sup>1, 2, 3</sup>





